# A Distributed Model for Effective National Geospatial Data Management

# or

# Building a National Data Sharing Infrastructure

## 1. Authors

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## 2. Abstract

Timely and accurate information is a critical component of successful multihazard mitigation and emergency management. For the past few decades geospatial professionals have developed vast quantities of data. Examples include data about the built environment such as parcel boundaries and building characteristics, transportation and utility infrastructure, population demographics and much more. For emergency management professionals the applications of such data are vast - ranging from generating informative real time maps to modeling the potential impacts of a flood or other hazard in support of multihazard mitigation planning goals.

Unfortunately, the potential value of these data is often unrealized or under realized. A report written by Peter Folger and published by the Congressional Research Service on April 27, 2012 titled *Issues and Challenges for Federal Geospatial Information* states that "Congress has recognized the challenge of coordinating and sharing geospatial data from the local, county, and state level to the national level, and vice versa. The cost to the Federal government of gathering and coordinating geospatial information has also been an ongoing concern. As much as 80% of government information has a geospatial component, according to various sources. The Federal government's role has changed from being a primary provider of authoritative geospatial information to coordinating and managing geospatial data and facilitating partnerships. Congress explored issues of cost, duplication of effort, and coordination of geospatial information in hearings during the 108th Congress. However, challenges to coordinating how geospatial data are acquired and used—collecting duplicative data sets, for example—at the local, state, and Federal levels, in collaboration with the private sector, are not yet resolved."

The existence of key geospatial data is often unknown or access is limited outside of the organization that develops it. Similar data are often created and maintained by multiple organizations, thus producing costly inefficiencies. Coordinated leadership between local, state, regional or national entities is often absent. As a result, data sharing strategies are often lacking or poorly organized.

This paper will examine these and other related issues and offer solutions that reflect the employment of effective coordination, carefully directed funding, and the application of current information technology tools and strategies. We will also offer suggestions that will build upon the anticipated successes of these initiatives. In particular, we will examine the various roles of Federal, state, and local

governments in regard to data creation and maintenance, data aggregation, creation of standards, and data dissemination, and link these roles to strategies that have produced successful initiatives. We will then discuss how the lessons learned from these efforts might be incorporated into a national strategy.

## 3. Statement of Problem

Accurate geospatial information is critical to successful multihazard mitigation and other aspects of emergency management. Over the past few decades, geospatial professionals across the county have developed geographic information systems (GIS) that include data about the built environment such as parcel boundaries and building characteristics, transportation and utility infrastructure, population demographics and much more. For emergency management professionals the applications of such data are vast - ranging from generating informative real time maps to modeling the potential impacts of a flood or other hazards in support of mitigation planning goals.

Given that as much as 80% of government information has a geospatial component, the cost to Federal, state, and local geospatial data stewards to create and maintain geospatial data is significant and cost efficiencies gained by a practice of "building once, using many times" are easy to imagine. Case studies show the value of appropriately applied geospatial data and technology. For example, a 2008 Indiana study of the return on investment of statewide aerial photography found that "over $1.7 billion in Indiana projects and government operations are supported by the IndianaMap [a statewide map and geospatial portal]. In short, this means that an initial investment of $8.5 million in the IndianaMap supports over 200 times its value in projects and operations – with 90% of users indicating that they could not do their projects without it." (Jill Saligoe-Simmel, 2008). Unfortunately, the potential value of these data is often unrealized or under realized.

Much success has occurred among different levels of government resulting in increased cooperation and, ultimately, in increased geospatial data sharing. Furthermore, while no single project or initiative completely resolves the challenges to effective data sharing, the summation of best practices gleaned from these experiences can inform a national data sharing model.

## 4. Return on Investment

Geospatial technology and the data required by that technology is expensive. In fact, the annual cost of producing geospatial data is measured in billions of dollars. (Federal Geographic Data Committee, 2005). Yet, an investment in geospatial technology and data has consistently proven to provide a positive return on investment (ROI).

For example, the 2008 Indiana ROI study mentioned above, clearly underscores the value of the IndianaMap in support of projects and governmental operations across the state. That report also concluded that the return on investment of statewide orthophotography acquired in 2005 was 34:1 in less than three years of use. (Jill Saligoe-Simmel, 2008).

Similarly, analysis performed by a team from Richard Zerbe and Associates which focused on the costs and benefits of the development and use of GIS within King County, Washington agencies determined that "GIS technology appears to be an efficient, highly beneficial investment for King County. The full

report presents various figures, but the most conservative estimate presented found that the use of GIS produced approximately $775 million in net benefits over the eighteen year period from 1992 to 2010." (Richard Zerbe and Associates, 2012).

A 2007-2008 analysis performed by the Geospatial Information Technology Association (GITA) on behalf of the Iowa Geographic Information Council, calculated a 20 year Net Present Value of $271 million associated with the costs and benefits of the geospatial information technology for all 99 counties of Iowa, 11 state agencies, three utilities plus Iowa One Call, and consulting firms. The study noted that "Many additional organizations were interviewed during the project but not all were able to provide quantifiable benefits." (Stewart, 2008). Clearly, these intangible benefits had value but were not measured, thereby increasing the overall benefit level beyond the stated number.

While the methods of these studies differ, the results consistently showed that investments in geospatial technology and data resulted in a significant positive return.

## 5. Identification of Best Practices (The pieces are all here)

The Authors truly believe the statement in the above title that "The pieces are all here." This "wheel" does not need to be re-invented, but simply de-constructed with the best practice pieces identified and reconstructed to create a new and improved wheel. The following examples were selected from a multitude of geospatial initiatives. These initiatives were chosen because they reveal one or more of the best practices that can be applied to a national model.

### USGS Liaison Program

#### *Program Description*

The United States Geological Survey (USGS) Geospatial Liaison Network consists of individuals housed in National Spatial Data Infrastructure (NSDI) Partnership Offices across the nation. These liaisons and offices perform numerous functions in support of the NSDI, The National Map and Geospatial One Stop. (Survey, 2012).

#### *Program Best Practices*

USGS Geospatial Liaisons serve a critical role by helping to facilitate collaboration between tribal, Federal, state, and local governments as well as with not-for-profit organizations, the private sector, universities, and consortia.

Where coordinating entities such as GIS councils do not exist, Liaisons both encourage and help to facilitate their development. When they do exist, the Liaisons ensure that they are aware of Federal initiatives that may have a strategic and/or financial impact on related tribal, state, or local objectives.

Liaisons also serve a critical role by ensuring that the USGS, as well as other Federal partners, are aware of tribal, Federal, state, and local activities. This can help reduce duplication of effort and it may spur new Federal initiatives or allow for the enhancement of existing initiatives that can leverage the investments in data and tool development made at other levels of government.

While the activities of USGS Liaisons are important in many ways, one area in which the value of the Liaison role is particularly evident is in disaster management. Efficient disaster management demands awareness and effective use of geospatial resources. Knowledge of these resources across all levels of government can have a significant impact on the ultimate toll that a disaster takes in terms of losses to life and property.

### *Summary of Best Practices*

Best practices that distinguish the USGS Geospatial Liaison Network program are:

- Facilitate communication and collaboration between Federal, State and Local partners
- Facilitate local access to Federal funds and programs to support local geospatial initiatives
- Facilitate local access to Federal geospatial resources during disasters

## The National Agriculture Imagery Program (NAIP)

The National Agriculture Imagery Program (NAIP) grew out of the United States Department of Agriculture – Farm Service Agency (USDA – FSA) need for a nationally available and consistent imagery product to support America's agriculture. NAIP was designed to support the basic need to create a historical imagery record that can quickly and accurately identify and measure vegetation and crop boundaries for inventory and planning, and support the measurement of both the health and stress on vegetation not evident to the naked eye for crop analysis and yield estimates.

### *Program Description*

The National Agriculture Imagery Program (NAIP) acquires aerial imagery during the agricultural growing seasons in the continental U.S. A primary goal of the NAIP program is to make digital orthophotography available to governmental agencies and the public within a year of acquisition. NAIP is administered by the USDA - FSA through the Aerial Photography Field Office in Salt Lake City (USDA-FSA-APFO).

The imagery data may be downloaded for free or copies purchased from the USDA. From the original DOQQ orthophoto GeoTIFF files, Compressed County Mosaics (CCM) are produced for easy distribution. The DOQQ file area corresponds to the USGS 7.5 minute topographic quadrangles. For each state, the most recent year of NAIP Imagery DOQQs is also available on an ArcGIS server. (USDA FSA Aerial Photography Field Office (APFO), 2011).

### *Program Best Practices*

NAIP is a national cooperative program with a proven track record. Beginning in 2003, NAIP was acquired on a 5-year cycle. 2008 was a transition year, and a three-year cycle began in 2009. An historic archive of NAIP imagery now exists for each state. In some states up to eight (8) different years of historic NAIP imagery are available. States for 2012 are shown in Figure 1, and previous years are shown in Figure 2 below.

NAIP also provides a contracting vehicle with built-in program administration and project/product management to acquire statewide imagery through cost share partnerships. Cost share partners can also "buy up" to acquire enhanced deliverables through the existing NAIP contract.

These components combine to make a program that has not only withstood the test of time, but improves each year in technology, product and price. Many states would likely not have a statewide ortho imagery base without the NAIP program.

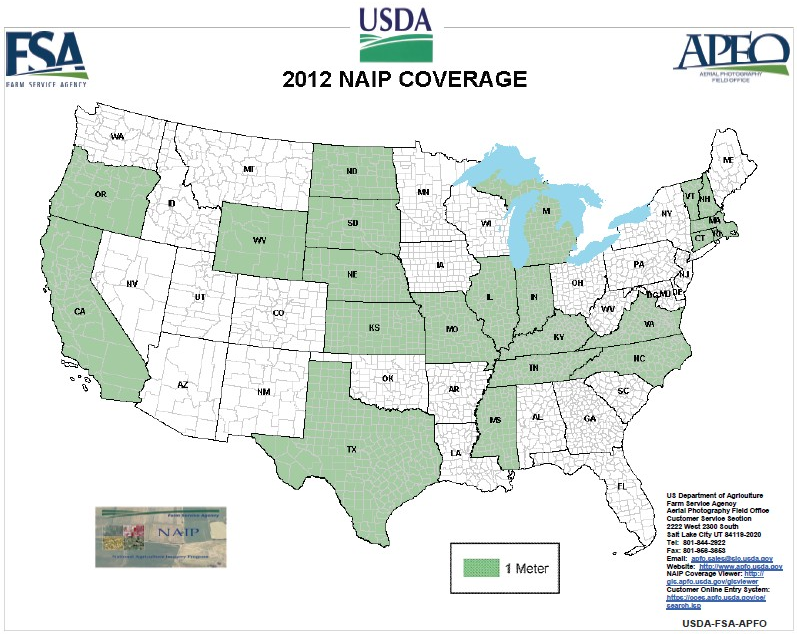



Figure 1

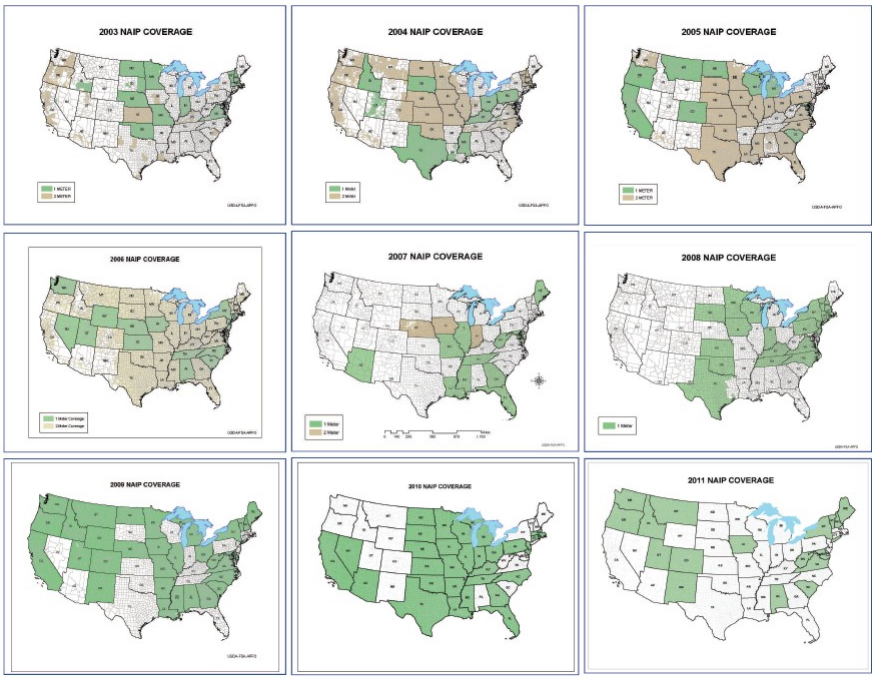



Figure 2

NAIP imagery is an example of how an historically consistent imagery product can be used for much more than supporting America's agriculture, and provides us with an excellent example of the "Build-once, Use many-times" model at work. Many other applications leverage NAIP imagery, such as disaster

preparedness and response, to general mapping activities in support of government coordination and planning, to commercial uses for real estate, construction and development.

### *Summary of Best Practices*

Some of the best practices that distinguish the NAIP program are:

- Nationwide availability and consistent imagery products
- Ongoing / repeatable program providing new and historic imagery
- Imagery data may be downloaded for free or copies purchased
- Project technology, products, pricing, and buy-up options improve over time
- Built-in program administration, project management, product quality control, and data distribution
- Provides a contracting vehicle for statewide imagery acquisition and product buy-ups through cost share partnerships.

## The National Broadband Map

It is well understood that access to high speed broadband has significant social and economic implications. For example, a 10% increase in broadband access means a 1.2 to 1.5 point increase in the United States GDP, according to Federal Communications Commission Chair Julius Genachowski. Chairman Genachowski went on to say, "We believe that broadband is a critical infrastructure challenge of our generation. It is to us what railroads, electricity, highways, and telephones were to previous generations." (Gardner, 2009). Understanding where no broadband service, or slow broadband service, exists is the first step to improving access for citizens. However, until the National Broadband Map was first published on February 17, 2011, there was no reliable and current nationwide picture of broadband availability with which planners could work toward making improvements. In fact, very few states had created such maps.

### *Program Description*

In July 2009, the National Telecommunications and Information Administration issued a Notice of Funding Availability (NOFA) in support of a State Broadband Data and Development Grant Program. This effort supported the creation and operation of mapping programs within each state (and U.S. territory) to produce broadband service area maps. The NOFA included a detailed specification that described the deliverable but did not dictate the process which produced the data, thereby, giving discretion to each state to create a process that best fits their unique environment.

Beginning on October 14, 2009, NTIA awarded a total of $293 million to 56 grantees, one each from the 50 states, 5 territories, and the District of Columbia, or their designees. From the National Broadband Map website, "Grantees are using this funding to support the efficient and creative use of broadband technology to better compete in the digital economy. These state-created efforts vary depending on local needs but include programs to assist small businesses and community institutions in using technology more effectively, research to investigate barriers to broadband adoption, innovative applications that increase access to government services and information, and state and local task

forces to expand broadband access and adoption." (National Telecommunications and Information Administration).

This all means that for less than $300 million over a period of only about 16 months, a project that involved all states and territories was launched that successfully created a complex nationwide geospatial dataset that met a specific set of common project specifications! In actuality, the initial cost is much less than $300 million, given that the grantees are using more than 50 percent of the grant funds to gather data twice a year for five years on the availability, speed, and location of broadband services, as well as the broadband services that community institutions, such as schools, libraries and hospitals, use. (National Telecommunications and Information Administration). The result is the National Broadband Map (NBM): a searchable and interactive website that allows users to view broadband availability across every neighborhood in the United States. In addition, many states published their own statewide broadband map.

As noted on the National Broadband Map web page, "The SBI (State Broadband Initiative) data is an ongoing, collaborative data collection, review and revision process that involves the combined efforts of local, state and Federal governments, broadband providers, private contractors, community anchor and academic institutions, and many community members across the country. Broadband providers voluntarily provided a majority of the data." (National Telecommunications and Information Administration).

### *Summary of Best Practices*

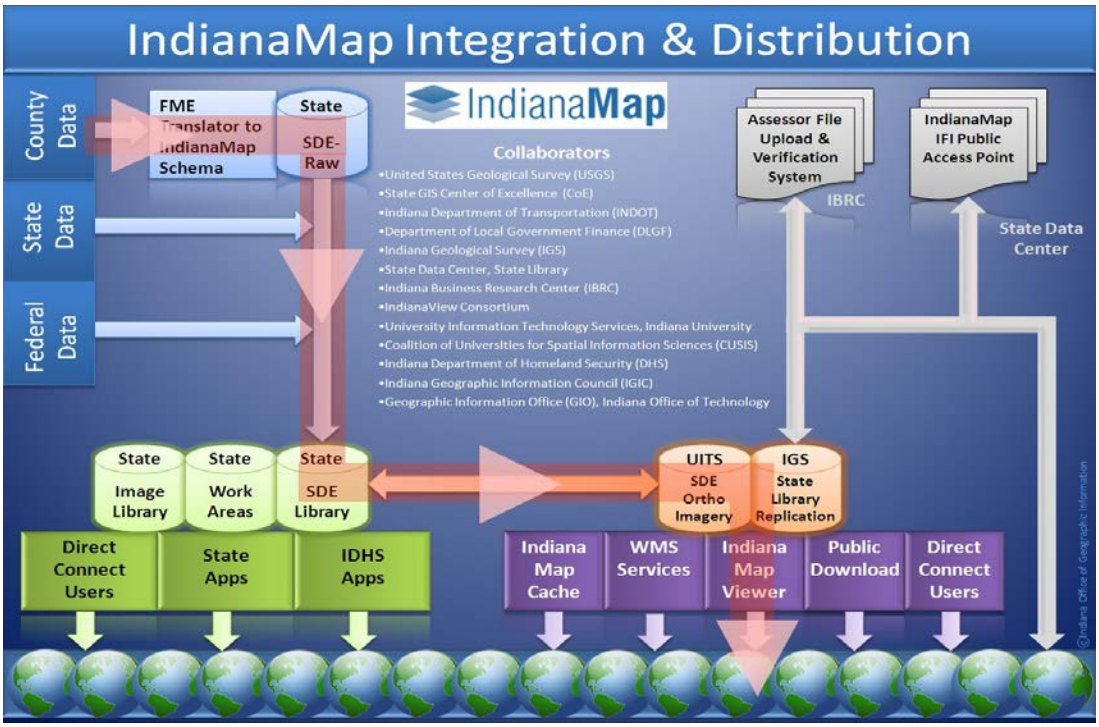
Using this approach as a model, it is easy to envision a National Map of FGDC framework data layers, created from state and territorial data contributions that is continually improved over time.

- At the Federal level, the NTIA created an "end target" but gave each state the discretion to create a project process that best took advantage of the local environment.
- Data was collected from local data stewards, such as the local broadband service providers, aggregated to meet a standard specification, and "rolled-up" to a national map.
- The results were widely distributed via the National Broadband Map and web maps published by the states.

## The Indiana Data Sharing Initiative

In the summer of 2008, a letter from the Indiana Geographic Information Office and the Indiana Geographic Information Council was sent to all Indiana county commissioners, to invite Indiana counties to voluntarily increase the value of the IndianaMap by contributing a minimum amount of local spatial information about land parcels, local road centerlines, point addresses, and administrative boundaries – datasets that are, appropriately, created and maintained by county governments. (The Indiana Geographic Information Council). By and large, these layers existed county-by-county, but not as a comprehensive, standardized, and unified statewide data layer. The goal of the initiative was to create an integrated statewide data layer for each of these four datasets using an open source Web Feature Service as the transfer technology.

This technology, and the processing, storage, and distribution infrastructure shown in the following diagram, allows periodic automated transfers that ensure the resulting IndianaMap information is reasonably current.




The benefits resulting from county participation are numerous and significant. Many of the issues that challenge Hoosiers do not stop at county boundaries – water and air quality, public safety, economic development, flood and other disaster planning and response, natural resource management, transportation planning, etc. These can all be better understood within the context of regional or statewide information. In fact, a recent study showed that of the $7.2 billion in projects supported by the IndianaMap, a full 75% were regional or statewide projects. (Jill Saligoe-Simmel, 2008).

One of the biggest challenges over the years has been the creation of a viable, sustainable technical data collection, storage, and distribution infrastructure and the human resources to manage and maintain it. Thanks to the collaborative efforts of over a dozen government, university, and private sector organizations, this infrastructure was put in place and ensures that up-to-date copies of the data can be periodically extracted from participants, moved through a "translation" process to homogenize the many different data standards that exist in the counties (rather than request that the counties modify their data to a state standard), and then provided to the IndianaMap. The resulting integrated product is made available to collaborators, including local government participants, the Indiana State Library, the Indiana Business Research Center, state government agencies, and the public via the IndianaMap.

While it is significant that the Data Sharing Initiative resulted in the production and distribution of four critical geospatial data layers that had never before been available as statewide data sets, the value is really in the use of the data rather than the data itself. As R.W. Greene pointed out in GIS in Public

Policy, “Realization is growing that almost everything that happens in a public policy context also happens in a geographic one: transportation planners, water resources studies, education subcommittees, redistricting boards, planning commissions, and crime task forces all must consider questions of where along with the usual ones of how, and why, and how much will it cost. GIS, by answering the first question, helps to answer the others.” (Greene, 2000). These four data sets, along with orthophotography and transportation data, form the foundation of geospatial context in support of informed governmental decisions. Nearly every “where” question that can be asked within a public policy framework or that must be answered in day-to-day governmental operations, must consider one or more of these data sets.

For example, the response to large natural disasters, like the large scale flooding that occurred across 82 Indiana counties in 2008, often takes coordinated response from local officials, responders, volunteers, Indiana National Guard, local and State Police, Federal agencies, the Red Cross, Animal Rescue, and many more - and that response requires coordinated data. The true value of the statewide data sharing initiative was again revealed when Clark County needed to respond quickly to the March 2012 tornados that devastated parts of southern Indiana. “We wanted to be able to quickly produce field maps and other geospatial data products to help our community, the Indiana Department of Homeland Security, and FEMA understand and best respond to the rapidly changing situation in our county,” said Vicky Kent Haire, Clark County Assessor. “Having accurate land parcels, road centerlines, and other data already integrated in statewide data layers before the event saved a lot of time in a situation in which every minute was critical.” (Haire, 2012).

Data layers, along with other geographic information (www.IndianaMap.org) have been shown to effectively lower the cost of doing business in Indiana. We know that the Data Sharing Initiative and the IndianaMap has supported over 1.7 billion dollars of projects across the state. For example, according to the survey responses which were collected as part of the 2008 IndianaMap ROI study:

- Spencer County used the IndianaMap to secure $2.5 million in grant funds to construct a Public Safety Building.
- The Perry County Port Authority used the IndianaMap to secure a grant for $7 million dollar railroad improvement, which encouraged $81 million in private investment.
- Huntingburg, Indiana, used the IndianaMap to seek a $1.3 million grant to improve their wastewater treatment plant.
- Indiana 15 Regional Planning Council used the IndianaMap to secure funds to identify and assess Brownfield sites for reuse.

Data Sharing Initiative partners included: Indiana Counties; Coalition of Universities for Spatial Information Sciences (CUSIS); Indiana Department of Homeland Security (DHS); Indiana Department of Local Government Finance (DLGF); Indiana Department of Transportation (INDOT); Indiana Geographic Information Council (IGIC); Indiana Geological Survey (IGS); Indiana GIS Center of Excellence (CoE); Indiana University Purdue University Indianapolis, The Polis Center; Indiana University, University Information Technology Services (UITS) and Indiana Business Research Center (IBRC); IndianaView

Consortium; State Data Center, Indiana State Library; and the United States Geological Survey (USGS). (Sparks, 2012).

In summary, the IndianaMap provides public access to view, query, and download more than 230 layers of GIS data. (Indiana Geological Survey). The available data includes aerial photographs and geospatial data layers related to infrastructure, demography, environment, hydrology and geology. Through the Data Sharing Initiative, four new critical statewide data sets have been added: land parcels, address points, road centerlines, and local administrative boundaries. Together these data are benefitting Indiana government, businesses, and universities. In addition, these data are available to be integrated into a National Map, and will provide a solid foundation for all future location-based efforts at a state and national level.

### *Summary of Best Practices*

- The initiative leverages the highly accurate and up-to-date information that is maintained locally and "rolls up" that data to the state level. This data then becomes available to Federal agencies.
- The State of Indiana does not require the counties to change their data or business practices for this initiative. Instead they use Safe Software FME (Feature Manipulation Engine) to "homogenize" the data after it is received.
- The State provided financial remuneration ($15,000 initially with an additional $6,000 that followed) to help counties with the technical transfer (with a little left over for the GIS uses).
- Having all the information in one central repository makes all new datasets very accessible.

## The Homeland Infrastructure Foundation-Level Data (HIFLD)

As a direct result of the attacks on America on September 11, 2001, our nation's emergency management community gained a greater appreciation for the need for readily available, nationwide, accurate geospatial information about our nation's critical infrastructure. As a result HIFLD was created.

### *Program Description*

HIFLD was established in 2002 to address improvements in the collection, processing, sharing, visualization, analysis, and protection of critical infrastructure geospatial information across multiple levels of government. The main components of HIFLD are the Working Group (HIFLD-WG), HIFLD to the Regions (HTTR), and the Homeland Security Infrastructure Program (HSIP) Gold and Freedom GIS databases.

**HIFLD-WG:** Working Group members represent every segment of the Federal Government, the States are represented by NSGIC, Federally-funded Research and Development centers, and Private Industry partners. The Working Group meets on a bi-monthly basis to advance the HIFLD mission and to focus on geospatial information in support of 18 different national, state, and defense level Critical Infrastructure Key Resource Sectors.

**HIFLD to the Regions (HTTR):** HTTR staff help focus HIFLD support on state and local priorities and issues to increase and enhance regional activities and to strengthen Federal, state, local, and private sector partnerships.

**HSIP Gold & Freedom:** A main focus of HIFLD is to provide the best available, national-level, current and authoritative geospatial data possible. The HSIP Gold database is a compilation of almost 500 layers of geospatially enabled infrastructure data sets addressing all 18 HIFLD Critical Infrastructure Key Resource Sectors. HSIP Gold contains both secure and licensed geospatial data to provide a common operating picture and baseline data for all HIFLD-WG Federal members. HSIP Freedom is a license-free subset of HSIP Gold available to Federal, state, local, tribal, and private sector contractors supporting emergency response and homeland security activities.

### *Program Best Practices*

HIFLD best practices are demonstrated at each regular scheduled face-to-face meeting and focus sessions held by the Working Group. By focusing on a specific sector, the attending members are provided with a valuable cross-sector education, new networking opportunities, and a creative problem-solving environment.

Additionally, the program and funding commitment by the four primary managing Federal partners: The Department of Defense, the Department of Homeland Security, the National Geospatial Intelligence Agency, and the United States Geological Survey are key. These partners recognize that their individual agencies have the vision but not the staff, technology or data resources to adequately accomplish this program. But they do have the financial resources to contract and direct HIFLD staffing to provide the day-to-day program support by engaging the private sector. Plus, they are establishing partnerships and contracts with the leading commercial geospatial data and technology providers to help develop the best available geospatial resources necessary to complete their mission.

### *Summary of Best Practices*

Best practices that distinguish the HIFLD are:

- Federal partners' leadership and funding model
- Private sector staffing for day-to-day support and advancement of the program
- Regularly scheduled face-to-face meetings and focus sessions
- Member cross-sector education and networking opportunities
- Connection to state and local governments through HIFLD to the Regions

## National States Geographic Information Council (NSGIC) – "For the Nation" Initiatives

From the 2012 NSGIC Advocacy Agenda: NSGIC believes that our Nation needs common geospatial data that are useful to all levels of government and others. Creating separate data for each level of government is wasteful. Since 2005, NSGIC has promoted its "For the Nation" initiatives, starting with Imagery for the Nation (IFTN). These initiatives must be built through consensus by all stakeholders to meet their collective business needs. Several states have begun to manage such programs with their local government partners. (National States Geographic Information Council (NSGIC), 2012).

### *Program Description*

The NSGIC proposal is for National data layers to be built by aggregating local data into statewide files that are provided to the Federal government, or through large area contracting efforts managed by state and Federal agencies to provide better products and save money. Over the years, NSGIC has

promoted this model for key geospatial framework data layers including Imagery, Transportation, Addresses, Parcels, and Elevation data.

### *Program Best Practices*

This advocacy and the dialog continue today, but we are seeing Federal led initiatives to move toward a national transportation, imagery, address, and elevation data solution. These best practices include:

**Transportation for the Nation (TFTN):** The NSGIC vision for TFTN is to begin with developing consistent, current, high quality road centerline data for the entire country. The initial focus of TFTN is to produce a single authoritative, accurate road centerline dataset that includes all types of roads, both public and private, nationwide. Building off this model, the US Department of Transportation, Geospatial Information Officer published a strategic plan for TFTN in 2011, and the FY2013 Federal Budget includes initial funding to the states to develop and roll-up a local road centerline network of their jurisdiction.

**Imagery for the Nation (IFTN):** This initiative was first proposed in 2005 as a partnership between Federal, state and local governments. The concept clearly demonstrated that costs could be shared and significantly reduced by creating products over large areas to reduce contracting costs. Although the National Agriculture Imagery Program (NAIP) incorporated most of the basic features of IFTN and is invaluable to many states, the entire initiative may be difficult to fund in this economy. A comprehensive contracting solution based on the Western States Contracting Alliance (WSCA) Public Cloud Hosting Services model is being planned by NSGIC for the states and their partners.

**Addresses for the Nation (AFTN):** The US Census Bureau, The US Postal Service, The National Telecommunications Information Agency, The Department of Homeland Security (Enhanced 911), to name a few, all need accurate point address data to support their missions. Expand this list to include all of the local government, state government, and regional government organizations that either create, maintain or use address data and we have a large community that today, either through legal or policy restrictions, are not sharing or collaborating on address data development and maintenance. NSGIC keeps this topic front and center, and as a result the Census Bureau is currently conducting five pilot projects to better understand and test options for a workable local -> state -> Federal roll-up model of address data.

**The 3D Elevation Program (3DEP) program:** The emerging 3DEP program initiative is being led by the United States Geological Survey (USGS) with other Federal partners, and is based on the results of their National Enhanced Elevation Assessment (NEEA) survey. (USGS, 2012). The NEEA is a comprehensive national survey that documented business uses for elevation data across 34 Federal agencies, from all 50 States, selected local government and tribal offices, and private and not-for-profit organizations. For Alaska, predominantly Interferometric Synthetic Aperture Radar (IfSAR) technology is being used to capture elevation data, and for the rest of the country Light Detection and Ranging (LiDAR) technology will be used for elevations. The LiDAR data will be acquired over an 8-year period to address 58 percent of the benefits identified in the NEEA; with a potential return on investment (ROI) for this data of $13 billion annually.

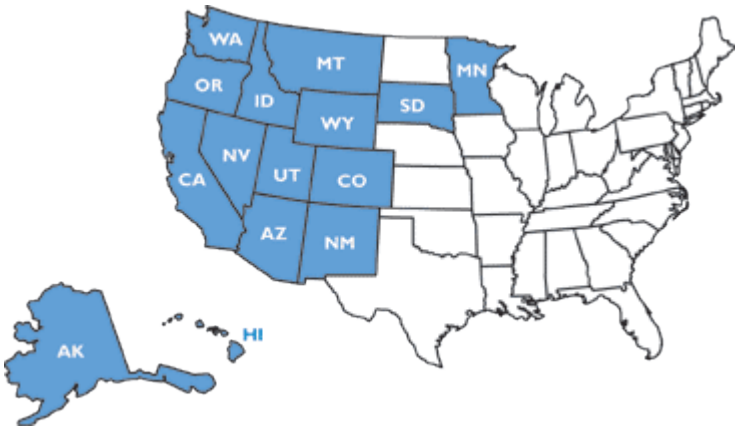
### *Summary of Best Practices*

Best practices that distinguish these "For the Nation" initiatives are:

- TFTN roll-up of local information to create a national coverage.
- TFTN bottom-up Federal funding of States to develop their local road centerline network.
- AFTN – Federal, State, Local partnership to understand the needs and best practices for development and maintenance of addresses.
- AFTN – Pilot project to develop and test best practices.
- 3DEP – Conducting a thorough nationwide elevation data survey and assessment.
- 3DEP – Federal to State to Local cost sharing model.

## WSCA Public Cloud Hosting Services

The Western States Contracting Alliance (WSCA) in collaboration with the National Association of State Procurement Officials (NASPO) provides a variety of cooperative multi-state contracts for the cost-effective and efficient acquisition of quality products and services for participating states to take advantage of through an aggregated purchasing model.




A lead-state is used to manage these multi-state and multi-vendor contracts, and all governmental entities within WSCA states, as well as approved governmental entities in non-WSCA states, can use the approved agreements.

### *Program Description*

Through a National States Geographic Information Council (NSGIC) initiative led by a consortium of four WSCA member states, Utah, Colorado, Montana, and Oregon, their state Chief Information Officers (CIO) established a "Public Cloud Hosting Services" contract to enable their states to move their GIS data to the Cloud. As a result, four contractors, Dell, Dewberry, Esri and Unisys were selected to provide these Infrastructure and Software as a Service cloud offerings. (National Association of State Procurement Officials (NASPO), 2012).

### *Program Best Practices*

Once Participating Addendums have been executed between each state and one or more contractors, that state's CIO becomes the manager of those individual cloud activities. Each state is treated as an Individual Customer but with access to all the standard products and services under the multi-state agreement.

### *Summary of Best Practices*

Although this is a very new program, some key best practices that distinguish the WSCA Public Cloud Hosting Services are:

- Helps states achieve cost-effective and efficient acquisition of quality products and services.
- A lead-state is used to manage all cooperative multi-state contracts under that program.
- Cooperative purchasing benefits states as well as Federal Agencies, Cities, Counties, and education institutions.
- Allows each state to focus more on geospatial data development, sharing and applications, and not the IT or GIS infrastructure.
- Helps establish a template for the NSGIC "For the Nation" (FTN) geospatial data initiatives.

## 6. What does not work

There are a number of impediments to realizing the benefits that geospatial technologies can bring to communities. We wish to highlight three in particular:

**a)** the perception on the part of some local governments that it is appropriate and useful for communities to charge fees for GIS data,
**b)** state laws that are difficult to interpret or that directly suggest that GIS data are not public records, and
**c)** redundant data collection efforts.

With regard to the first item – the perception that GIS data should be sold by communities to generate income - we recognize that communities do and should seek creative solutions for financing those things for which they are responsible to include public safety, infrastructure maintenance, and an array of other critical government services. However, we argue that selling GIS data to fund these types of services is counterproductive. As noted earlier in this paper, returns on investment studies have made a convincing argument that data has more value when it is freely distributed and utilized. Communities that sell GIS data restrict the potential applications of their GIS data by only making it available to those that can afford its purchase.

The second impediment relates to, but also extends beyond, the issue of selling data. The Freedom of Information Act (FOIA) ensures public access to U.S. government records. However, this only applies to Federal agencies. Each state has its own public access laws which vary significantly from state to state. Unfortunately, these laws are not always clear on the question of whether GIS records are public records – which would typically make them available at minimal to no cost upon request. In some cases these laws directly deny the classification of GIS data as public records, thus allowing communities to charge for their GIS data at a rate of their choosing. As a result, lawsuits have been filed in recent years that ask questions such as 'Are GIS data public records?', 'Can a government agency charge for GIS data?', and 'Can a government agency copyright, license, or restrict downstream use of GIS data?'

Decisions in these court cases have been inconsistent. Some of the more notable examples include a 2008 case in which the key issue was whether the Village of Sussex, Wisconsin could avoid liability under open record laws by managing their data through an independent contractor. The independent

contractor claimed copyright protection of its database. In this case, the court concluded that the Village of Sussex was responsible to provide the GIS data in compliance with open records laws and could not hide behind a contractor. (Wiredata Inc v. Village of Sussex, 2008). In 2008, Horry County, South Carolina argued the right to claim copyright for GIS data, charge a fee (royalty) for use of copyrighted data and restrict the downstream use of the GIS data. In this case, the court determined that Horry County could claim copyright and restrict the downstream use of the data. (Seago III v. Horry County, 2008). In yet another example, Santa Clara County, California used the Homeland Security Act to overturn a previous judicial decision by arguing that the Homeland Security Act protected the information from disclosure; the requested information was exempt from disclosure under the California Public Records Act "catch-all clause"; and that the County can place restrictions on disclosure under state law provisions recognizing its copyright interests, and it could demand fees in excess of reproduction costs. The court concluded that the submitter of data to the Federal government was not protected by the Homeland Security Act, that Santa Clara County could not prove that in withholding the GIS data the public interest was better served and that California law provided for copyright for software and not for public records – in other words that data could not be copyrighted nor could a fee be charged greater than the cost of reproduction. (County of Santa Clara v. Superior Court, 2009). The battle for the rights of local governments to restrict data access to GIS data in California continues to the current time in a case now before the California Supreme Court that is set to determine whether Orange County's computer database of public land records is exempt from disclosure under the Public Records Act. (Orange County Superior Court v. Sierra Club, Current).

As already argued, the best GIS data is local data – typically generated at the county level – and the inconsistent access to information due to the wide range of restrictions imposed by public records laws at the state level is a significant challenge that must be overcome in order to make this high quality data accessible in a consistent fashion.

The final impediment concerns the continuing issue of redundant GIS data development. In the early days of modern GIS it was not uncommon for multiple government agencies to collect similar – if not identical – GIS data. This problem, while not as severe as it once was, still persists today. Redundant GIS data development activities sometimes occur between Federal agencies, states and counties. This can happen for many reasons but among the most common are the lack of awareness about different data collection activities between organizations resulting from inefficient communication protocols and the lack of infrastructure – both political and technical – that encourages collaboration on the development and management of GIS data. Fortunately, as already noted, there are efforts underway to address these issues, including the USGS Geospatial Liaison network and various GIS consortia. As a result of these efforts, best practices such as those noted earlier in this paper are now emerging that reveal efficient ways to share in the collection of GIS data such as aerial photography, transportation infrastructure, and other resources of mutual interest.

## 7. Proposed National Model

Many of the best practices presented here can be applied to a new national model for sharing geospatial data. In particular, the best practices can inform how appropriate roles at each level of government can facilitate the sharing of geospatial data. Federal agencies can provide direction, leadership, and most

importantly partnership funding. This is the Federal role for the National Broadband Mapping project. The FCC and NTIA responded to a need for better geospatial data in order to understand where high speed broadband was available, and where it was not available. These agencies produced a detailed description of a broadband geospatial data product that located service areas, service speed, type of technology used, and service provider name. Project funding to the states was provided via a Federal grant. The data that was created was made available by way of a National Broadband Map.

An appropriate role for state government is one of coordination and integration. Continuing the broadband mapping example, states and territories, as grantees, coordinated with local broadband service providers, collected and integrated that data to a common standard, and made this data available to NTIA.

Indiana played a similar role in the data sharing project by working with counties to collect and integrate land parcels, address points, road centerlines, and local administrative boundaries. These four data sets, once collected and integrated as statewide data layers, have been made available to Federal agencies and the public. The Western States Contracting Alliance (WSCA) cooperative multi-state contracting model is an excellent example for the efficient acquisition of GIS infrastructure. A similar model can also be applied to the acquisition of regional or statewide orthophotography and LiDAR products and services with a state serving as the contracting agency.

Local data stewards from municipalities and counties create and maintain rich, detailed, and accurate data that describe their local environment. This role is appropriate. These stewards are the experts about their land parcels, point addresses, road systems, surface waters, natural resources, etc. and create these data to support their communities.

The National States Geographic Information Council (NSGIC) also has a role in helping to liaison between state and Federal agencies to create geospatial standards and policies, as it did when it created the database structure for the broadband mapping project and as it worked with the FGDC to develop data standards.

These Federal, state and local roles can facilitate two different approaches to national data sharing models: buy-up and roll-up.

### The Buy-Up Data Sharing Model

The NAIP program provides a good example of how Federal and state governments can coordinate and cooperate. The USDA – FSA determined a minimum specification for an orthophotography product acquired to study agriculture, and funded a program to deliver that base product. Importantly, the USDA – FSA decided to allow states to add funds to increase the resolution of the imagery to better suit the needs of the state. From the Federal perspective, such a buy-up adds value to the resulting data. From the state perspective, a valuable data set was obtained at a discounted cost.

States often follow this model by building into their orthophotography projects the possibility of counties and cities choosing to pay an additional – albeit discounted – fee in order to increase the resolution of the photography for their area of interest.

The buy-up model requires a level of coordination sufficient for project and funding planning. In return, project partners receive products at a discounted cost from what they would individually pay.

The buy-up model is appropriate for projects that cover large geographic areas and in which new data is produced as "one-time" data creation projects, such as those involving statewide orthophotography and LiDAR.

### The Roll-Up Data Sharing Model

The national broadband mapping program and the Indiana Data Sharing Initiative are examples of how data can be created and maintained at the local level and then rolled-up to the state level where standards are enforced and the resulting integrated data is made available to the Federal government. It is easy to envision a national parcel map or a national address point map using the roll-up model, especially if some portion of the Federal geospatial budget could be directed to the local data stewards.

The roll-up data sharing model is appropriate for data sets, such as land parcels and address points, that are incrementally developed by local stewards and are continuously updated and improved over time.

## 8. Steps for success

Several steps that will be required for a national geospatial data sharing model are articulated in a document titled "*State Position on National Geospatial Data Policy*". (NSGIC, September 10, 2012).

1. "Federal programs should be coordinated across Federal agencies." We add that this would best be accomplished by creating a Federal Geographic Information Office.

2. "Federal data collection activities should include cooperative options for state and local buy-ups."

3. "Federal agencies should notify states of any data collection activities in their area. States can then participate appropriately, possibly by curtailing redundant efforts or providing additional funds to enhance the Federal effort."

4. Federal agencies should notify states of pending grant and contract programs. The states can then notify local governments and help develop better proposals to meet national needs."

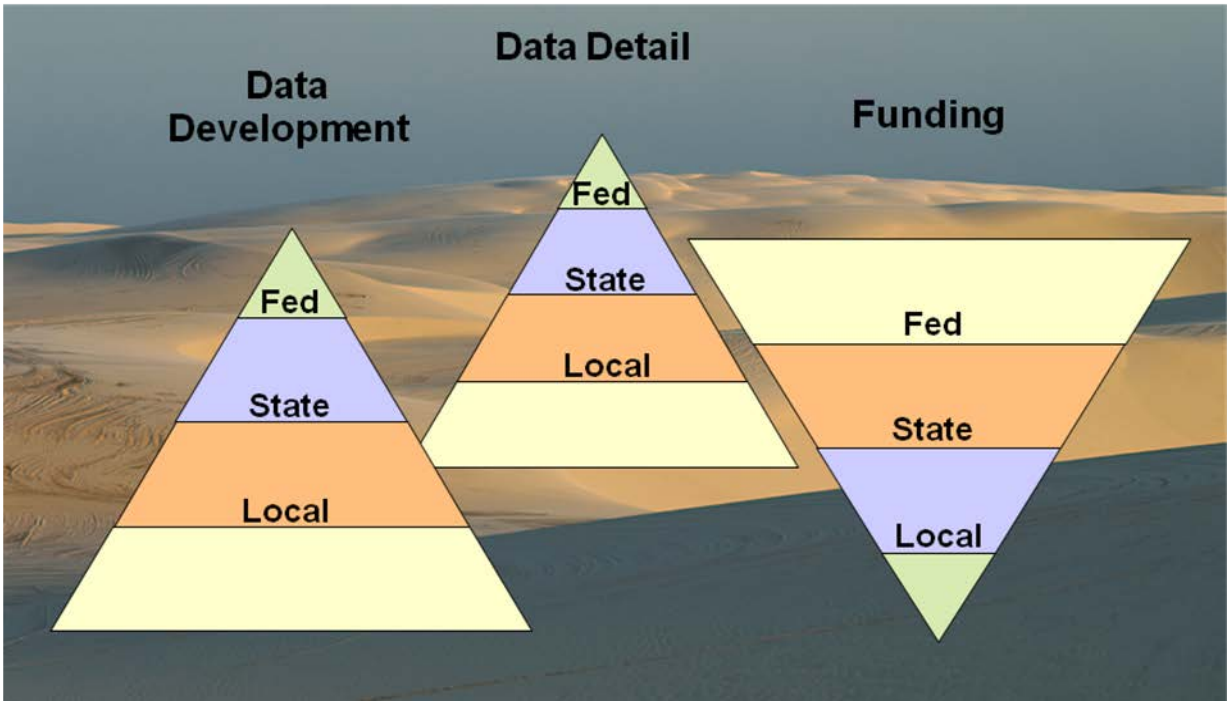
5. "Federal agencies and state governments should work together to develop a common understanding of program requirements and the data required to meet those needs."

6. "When appropriate, states should be allowed to help manage Federal grant/contract programs within their borders. This will provide states with a better understanding of the underlying data to produce positive long-term results."

**The Authors** of this paper additionally recommend that:

7. Two percent of the Federal geospatial budget should be redirected to city and county data stewards to support ongoing maintenance of land parcels, address points, local administrative boundaries, road centerlines, and other critical local data. These redirected funds would enable

local governments to continue to produce and maintain high quality data and reduce their need, actual or perceived, to "sell" data in order to add dollars to their operations budget. This financial support would recognize the quality, quantity, and detail of local data and would correct the imbalance that currently exists between local funding and their rich data holding as shown in the diagram below. Moreover, as these local data are rolled up to state and Federal levels, state and national "maps" can be created using better data for lower costs.




## 9. Conclusion

This paper has reviewed the vital role that geospatial technologies and data play in supporting public safety – including the critical role served by multihazard mitigation planning, infrastructure management, economic development and many other needs of our nation. The value of such data is not in question now, nor has it been for some time. In recognition of the importance of these data, many Federal, state, and local entities have undertaken programs to collect, maintain, and distribute geospatial information. Nevertheless, there remains a critical need for a national strategy that will encourage and support the development of these data. This paper has proposed a model for a strategy, based on a combination of best practices from current and past initiatives as well as a number of new ideas to leverage technological advancements and other resources. Successful implementation of this national strategy will meet the needs of all levels of government and those they serve by empowering them with the information necessary to address challenges and pursue opportunities at local, regional and national scales.

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